

NOTES ON AMERICAN WILLOWS

II. THE SPECIES RELATED TO *SALIX GLAUCA* L.

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In my first paper¹ I dealt with *Salix arctica* Pall. and its relatives. These species are mostly united with *S. glauca* L. and its congeners in one group or section by such American salicologists as P. A. RYDBERG and C. R. BALL. European students of willows like N. J. ANDERSSON, A. and E.-G. CAMUS, and O. v. SEEMEN referred the two species to different sections, and I have always thought it best to regard each species as a representative of a distinct group. It is not an easy task to draw a line between the forms of the GLAUCAE on the one hand and those of the *arctica* group on the other, but this is true of most of the sections in a genus like *Salix*, where it is difficult to define groups of closely related species. As I have already explained in SARGENT, Pl. Wils. 3:136. 1916, the name ARCTICAE is not available to designate the group of which *S. arctica* Pall. is the type, because it was first used by ANDERSSON (1858) for a section containing *S. Hookeriana* Barr., *S. speciosa* Hook. and Arn., non Host. (*S. alaxensis* Cov.), etc., which in 1868 ANDERSSON included in his sect. NIVEAE B. VILLOSAE; therefore I (*l.c.* 140) proposed the name DIPLODICTYAE for this group, but at this time I also kept the OVALIFOLIAE of RYDBERG as a separate unit, expressing, however, a doubt "whether the species united by RYDBERG in this section really belong in the same group." At present I believe that *S. ovalifolia* should be placed in the same section with *S. arctica*, and consequently the name OVALIFOLIAE must be adopted for this group. To distinguish between those two sections the color and pubescence of the bracts (or scales) seems to afford a rather reliable character. In the OVALIFOLIAE the bracts are usually more or less bicolor, being pale at base and dark brown, fuscous, or even blackish toward the apex, while the forms of the GLAUCAE mostly have uniformly yellowish, light brown, or straw-colored bracts, which sometimes (especially in the upper part of

¹ BOT. GAZ. 117-142. 1918.

the ament) are reddish or purplish toward the apex, but never become really fuscous or blackish. Furthermore, the pubescence of the 2 kinds of bracts is of a different character. In the first group it usually consists of rather long, straight, silky hairs, of which at least the uppermost are about the same length as the bract, which mostly does not bear many short hairs on its surface, and often becomes nearly glabrous. In the second group the hairs are comparatively shorter, less straight, and rarely distinctly silky, but are softer and sometimes a little curly. As a whole the bracts are more or less covered with pubescence, and are rarely distinctly ciliated at apex with long silky hairs. These characters are usually more easily detected in the female than in the male specimens, which are often more similar in the two groups. It takes some time for the student to become familiar with these peculiarities, which are by no means clearly recognizable in every specimen. There are of course exceptions also, but in such cases we find other characters to determine the real affinity of a certain form. Many so-called intermediate forms are of hybrid origin, or should receive closer observation in the field before defining their taxonomic position. This is what I have to say at present regarding the separation of the sections GLAUCAE and OVALIFOLIAE. Later I hope to have the opportunity to discuss in detail the systematic arrangement of the American species of *Salix*.

As I now understand them, the following species belong to the section GLAUCAE: *S. anamesa* Schn., *S. brachycarpa* Nutt., *S. chlorolepis* Fern., *S. cordifolia* Pursh, *S. desertorum* Rich., *S. fullertonensis* Schn., *S. glauca* L., *S. lingulata* And., *S. niphoclada* Rydbg., and *S. pseudolapponum* v. Seem. I do not include in this group *S. chlorophylla* And., *S. McCalliana* Row., *S. Nelsonii* Ball, *S. saskatchavana* v. Seem., and *S. idahoensis* (Ball) Rydbg., which RYDBERG places in his section ARCTICAE (Fl. Rocky Mts. 190. 1917), which seems to me an unnatural mixture of species of different affinities.

1. *S. GLAUCA* L., Sp. Pl. 2:1019. 1753.—Before we can decide whether any American forms or which of them are to be referred to this species it seems necessary to discuss the characters of the typical *S. glauca* L. It is founded on "363. *Salix* foliis integris subtus tenuissime villosis ovatis. Tab. VIII. fig. p. and Tab. VII.

fig. 5" in LINNAEUS' Fl. Lapp. 290. 1737. The description and figure given by the author in this place give a rather good idea of his type. Furthermore, ENANDER (Stud. Salic. Linnés Herb. pp. 51, 54, 59. 1917) describes the female and male specimens of *S. glauca* genuina, typica or vera in Linnaeus' herbarium. Following LINNAEUS and ENANDER, I find the following characters of what has to be called the typical *S. glauca*: Frutex bi- vel tripedalis. Rami rubescentes, glabri; ramuli novelli villosi. Folia ovata, lanceolata, ovali-lanceolata vel ovato-oblonga, utrinque fere aequaliter attenuata vel inferiora apice obtusa, superiora magis oblonga acutiora, integerrima, 15:8 vel 40:12 ad 60:15 vel 55:20 mm. magna, utrinque (subtus tamen densius) villosi vel superne pilis parcius obsita vel fere glabra, non vero nitida, subtus pallidiora, "villis oblongis raris hirsuta" vel "pilis albicantibus vestita"; petioli 8-10 mm. longi, villosi; amenta pedunculis ad 3 cm. longis foliolis circ. 4 ceteris similibus instructis suffulta; flores masculi bracteis pallidis pilosis, filamentis basi pilis crispatis ornatis antheris testacei coloris instructis; feminei bracteis similibus, ovariis capsulisve tomentosis sessilibus, stigmatibus stylisque quasi semipalmato-alcicornibus.

Not having sufficient herbarium material from Lapland at my disposal, I think it best to add the following characters given by ANDERSSON in his Salic. Lap. 73, fig. 21. 1845:

Amenta serotina ramulos breves crassiusculos tomentosos foliis ceteris vix minoribus 3-6 vestitos terminantia, iisque plerumque longiora, cylindrica, obtusa, erecta, demum sublaxa; mascula 1-2 uncialia, densa, squamis oblongis, obtusis, fulvis apice roseis, pilis albis longis rectis villosissimis, stam. 2, filamentis fulvis, basi barbatis, antheris globosis prius coerulescenti-roseis; feminea subdensiflora, abrupta, obtusa, 1-3 uncialia, primum rigida, demum laxa, squamis fulvis apice roseis, oblongis, obtusis, ventrem capsulae superantibus, albo-villosis; capsulae pedicello nectario lato quadrangulati pl.m. profunde partito, dimidio breviori, brevissime pedicellatae, ovaes vel conicae, obtusae, lana alba densissime tomentosae, stylis aut omnino geminis aut fere usque ad basin bipartitis (ut eorum pars, quando adest, semper sub lana capsulae lateat), stigmatibusque linearibus divaricato-bipartitis, rufo-fulvis terminatae.

Judging by these characters we have to decide, I believe, whether there are in America forms identical or closely related to the typical

S. glauca from Northern Europe. According to the leading European salicologists *S. glauca* is rather variable, but I fail to find a good arrangement of the different variations already known from Europe and Northern Asia in the existing literature. It is impossible to judge the American forms correctly without having a clear understanding of the Asiatic forms already described, because it is to be expected that the forms from Eastern Asia will have the closest affinity with the American forms.

No mention is made of *S. glauca* by PURSH (1814) or MICHAUX (1820), or even by HOOKER (1839). It was ANDERSSON who in 1858 first mentioned *S. glauca* as occurring "in provinciis septentrionalibus et arcticis Americae borealis." He further said:

Haec species in arcticis regionibus Americae habitu externo vix nostrae similis exstat. Specimina tamen a Seemann in parte occidentali et a Lyall in Disco Island lecta, nec non e "Rocky Mountains" reportata cum nostris tamen ita congruunt, ut de identitate non dubitare liceat. Folia nunc utrinque molliter villosa et incana, nunc denudata subviridia, amenta semper foliato-pedunculata, capsulae brevius pedicellatae. Huic certissime ut forma tantum associanda—*villosa*. *S. villosa* (D. Don) Hook. *l.c.* p. 144, no. 3.

This *S. villosa* Barratt apud HOOKER has to be ascertained before anything else can be done to determine which forms may be referable to *S. glauca*. HOOKER (Fl. Bor.-Am. 2:145. 1839) said: "that Dr. BARRATT considers it to be the same as *S. villosa* of D. Don, in Pursh, Herb. Canad." I have never seen specimens from a "Herb. Canad." of PURSH, nor do I know whether PURSH ever distributed such a collection.² Neither he nor D. DON published a *S. villosa*; there are, however, two species bearing this name, one of SCHLEICHER (Cat. Pl. Helv. ed. 3.26. 1815) which is a nomen nudum and was probably first mentioned in the first edition of the Catalogue in 1809; the other of FORBES (Salict. Wob. 183. pl. 92. 1829) representing a sterile specimen of unknown origin. Thus the

²There is, however, a specimen, consisting of 3 leaves only, in herb. N. labeled "*Salix leucodendron* D. Don, in Pursh's Canadian Herb. (collected in Lord Selkirk's Exped. from Mr. Lambert's Herb.)." DON did not publish a species *S. leucodendron*, and I am not yet sure to which species these 3 leaves belong. PURSH's herbarium was in possession of LAMBERT (see Gard. Chron. 1842, p. 439), but PURSH himself did not collect in Canada at all (see HARSHBERGER, Bot. Philad. 115. 1899). I have not been able to get any information on "Lord Selkirk's Exped."

name *S. villosa* Barr. cannot be used even if the form described by HOOKER under this name could be recognized as a good species. I have been fortunate in seeing photographs and fragments of the types of *S. villosa* preserved at Kew, and also the corresponding specimens of BARRATT'S collection in herb. N., and I am convinced that HOOKER included different forms under his *S. villosa*. At first glance his diagnosis fits well the forms described by RYDBERG as *S. Seemannii* (see later) and the material before me from the Yukon Territory, but the character given by HOOKER in the following phrase: "rami foliisque junioribus lana arachnoidea villosis" seems peculiar to me. I cannot detect traces of a "lana arachnoidea" on the specimens before me, and furthermore, the specimen collected by DRUMMOND (no. 7. Herb. H. and B.) which is regarded as the "type" is not characterized by "foliis lato-lanceolatis." There is, however, a specimen in Herb. Torrey (N.) labeled "no. 6. Herb. H.B. and T." and "an *S. villosa* D. Don" in which the lower surfaces of the lanceolate leaves are covered when young with a "lana arachnoidea," the prominent rib being nearly glabrous, while the lateral nerves are almost hidden by the pubescence. Later the leaves become more or less glabrous, and the first or lowermost leaves show nothing but a few scattered long silky hairs. The petioles are nearly glabrous, and the stipules are very small, hardly a fourth of the length of the petiole, very glabrescent, semiovate, and denticulate. This does not agree with HOOKER'S statement: "stipulis semicordatis petiolo sublongioribus," which is the case in no. 7; and HOOKER'S diagnosis seems to me only explicable if we presume that he mixed two different forms. On the same sheet with no. 6 is also an old fruiting catkin with a leafy peduncle which is identical with those of no. 7. I am not yet sure to what species the sterile branch of no. 6 really belongs.

HOOKER also described a var. "*β. acutifolia*; foliis magis acutis vel subacuminatis," collected by RICHARDSON at Fort Franklin on the Mackenzie River, of which a photograph of the type "no. 76. Hb. H.B. and T." is before me. It consists of 3 pieces of young female flowering branchlets. I also saw a sheet with the label "no. 58. Hb. H. B. & T." ex herb. Torrey (N.) marked "Fort Franklin, Richardson," which contains 2 fruiting and 1 sterile

branchlet of var. *acutifolia* named by RYDBERG *S. villosa* and marked no. 2. Besides these there are 2 sterile branchlets which may belong to var. *glabrescens*; the upper middle one was referred by RYDBERG to *S. villosa*, while the small one at the left corner of the lower label is without number. Furthermore, there are 3 sterile branchlets numbered 1 and named *S. chlorophylla* by RYDBERG which indeed look very much like this species or may be referable to *S. pulchra* Cham. All the specimens are referred (by BARRATT?) to *S. planifolia* Pursh, a very uncertain species which may be identical with *S. chlorophylla* And.

As already mentioned, ANDERSSON regarded HOOKER'S *S. villosa* in 1858 as only a variety of *S. glauca* L. He said: "Haec forma speciei maxime vegeta videtur," and in his short description (in Öfv. K. Vet.-Akad. Förh. 15:109) we read: "foliis tenuioribus, supra (sic!) glaucis, sparse pilosis, elevato-venosis, stipulis subpersistentibus lanceolato-linearibus; amentis sat longis erectis laxiusculis, subrarifloris" The same diagnosis is repeated in Sal. Bor.-Am. 22, and in Walp., Ann. Bot. 5:753. 1858. The statement "foliis supra glaucis" is certainly a misprint for "subtus glaucis," or it may be that a whole sentence has been omitted. Unfortunately, ANDERSSON did not cite a specimen, but his description scarcely fits the Rocky Mountain material collected by DRUMMOND. Ten years later ANDERSSON (in DC. Prodr. 16²:281) proposed a new hybrid *S. glaucops*,³ which he placed without a number between 107. *S. glauca* and 108. *S. desertorum*, and of which he describes 2 "modifications," namely, var. *villosa*, being identical with his former *S. glauca* var. *villosa*, and var. *glabrescens*, which he based on specimens collected by BOURGEOU in the Rocky Mountains, and with which I shall deal later.

ANDERSSON referred to his *S. glaucops villosa* not only HOOKER'S *villosa* and his own *S. glauca villosa*, but also *S. villosa* Seemann ("Voy. of Herald. p. 39.54") and "*S. cordifolia* Hook. Fl. Boreal.

³ It ought to be mentioned that this species has been entirely misunderstood by M. J. JONES, Willow Fam. Great Plat. 16. 1908. The author says of his study: "This work, on western willows, is put forth tentatively in order to clear up doubts. . . ." But he certainly succeeded in greatly augmenting the existing confusion in regard to many species. There are scarcely 2 willows better distinguished than *S. glaucops* And. and *S. subcoerulea* Pip., which JONES makes synonyms.

amer. p. 152. p.p. (non Pursh).” SEEMANN’S plants came from western Eskimaux-Land (Northwestern Alaska from Norton Sound to Point Barrow), while HOOKER’S specimens to which ANDERSSON alludes were collected in Labrador. The Rocky Mountain specimens mentioned by HOOKER are not included, as they had already been described by ANDERSSON as *S. subcordata* (*S. arctica* var. *subcordata* Schn., see my first paper). ANDERSSON’S main description of *S. glaucops* fits best Seemann’s specimens, and such forms as *S. villosa acutifolia* Hook., of which ANDERSSON made no mention at all either in 1858 or in 1868. According to the rules of nomenclature the name *S. glaucops* has to be applied to the *S. glauca* of Alaska, the Yukon, and the Mackenzie district if further investigations should prove that these forms can be regarded as a distinct species. Unfortunately, this name has been used by RYDBERG (1899) and BALL (1909) to designate a more southern form of the Rockies, for which I use the name *S. pseudolapponum* v. Seem. (see later). When BALL first treated this form in 1899 (Trans. Acad. Sci. St. Louis 9:88) he expressly said: “Our Rocky Mt. form was included under *S. glauca villosa* by Mr. BEBB, but it is certainly not the *S. villosa* Don described by HOOKER (Fl. Bor.-Am. 2:144) and later published by ANDERSSON as *S. glauca villosa* (Sal. Bor.-Am. 22). That had long leaves and thick aments 2-3 inches long, being thus more closely related to the European *S. glauca*,” and (l.c. 89) BALL designates *S. glauca* var. *villosa* And. (*S. villosa* Barr., *S. glaucops* And.) as a form of which “full discussion must be deferred until more abundant material is accessible.” He adds that “HANSEN’S no. 800, Fl. Sequoia Reg., 1892, is a plant which nearly answers the original description,” but in my opinion HANSEN’S specimen differs widely from it, and belongs to *S. californica* Bebb, a fact suggested by BALL himself.

According to RYDBERG (1899), *S. glauca* is “apparently rare in America, and probably confined to the extreme northeast portion.” Nevertheless, he cites, besides specimens from western Greenland and Labrador, “Alaska: Nurkagak, 1881. McKay,” meaning Nushagak in the Bristol Bay. This specimen is referred by COVILLE to *S. glauca*. Furthermore, in 1901, RYDBERG described a *S. Seemannii*, the type of which had been “collected at Dawson

by R. S. WILLIAMS, June 11, 1899, a more mature specimen June 12. Also collected by SEEMANN on Chamisso Island, 1851, no. 1873, and Kotzebue Sound and Norton Sound, 1849, no. 1423." He accompanied his description with the following remarks: "SEEMANN'S specimens, cited below, were named by HOOKER *S. glauca* var. *macrocarpa*, but the plant is neither *S. macrocarpa* of TRAUTVETTER nor that of NUTTALL; it is related to the former, but not to the latter. *S. macrocarpa* Trautv. (*S. glauca macrocarpa* Ledeb.) is described as having sessile stigmas and fuscous bracts; it probably does not occur in America." In the original description of *S. macrocarpa* Ledeb. apud TRAUTVETTER (in Nouv. Mém. Soc. Nat. Mosc. 2:292. 1832) I fail to find the statement that the stigmas are sessile; this part of the diagnosis runs: "stylo basin usque bipartito, stigmatibus bifidis." TRAUTVETTER compares in detail *S. glauca* and *S. macrocarpa*, and attributes to the latter the following characters: "frutex pedalis prostratus," "folia majora, acuminata, juniora jam fere prorsus glabra," and "pedicellus interdum fere longitudine ovarii." The same statement is given for *S. glauca* β *macrocarpa* Trautvetter in LEDEBOUR, Fl. Alt. 4:281. 1833. Judging by those characters the American form in question cannot be identified with this var. *macrocarpa*, but better agrees with what TRAUTVETTER (1832) regarded as typical *S. glauca*, and named *S. glauca* var. *microcarpa* Ledeb. in 1833. Here TRAUTVETTER says, after having given an ample description of the specimens from the Altai, "exemplaria altaicis simillima Cl. Eschscholtz legit ad Cap. Espenberg."

As already stated, it is difficult to decide at the present status of our knowledge of the Old World forms of *S. glauca* whether some of them are identical with the American forms. So far as I can judge by TRAUTVETTER'S descriptions and the material I have seen from Asia, I am not convinced that the forms of Northwestern America can be regarded as representing the typical *S. glauca* or one of TRAUTVETTER'S varieties. A keen and careful observer like COVILLE, in 1901, said: "There is a tendency among American willow students to exclude *Salix glauca* from the North American flora, but our Alaskan specimens show so close an agreement with some European material of this species that I am unwilling to

separate them." He adds that he is not "able to find in the description [of *Seemannii*] a record of any characters that serve to distinguish the specimens assigned to the latter species from forms of *glauca* found in America and Europe." I agree with COVILLE that the North American forms are very similar to those of *S. glauca*, but they are in my opinion not fully identical with the typical *S. glauca* L. s. str., the characters of which I have already indicated. In looking over the copious and well collected American specimens before me, I hesitate to designate them as typical *S. glauca*, nor am I willing to regard them as a separate species until a closer study of this circumpolar willow has convinced me of one fact or the other. Those specimens exhibit a great degree of variability in the shape and size of the leaves, in the amount of pubescence, in the length of the aments, and in the characters of the flowers. As a whole they seem to differ from the typical *S. glauca* by the usually well developed stipules, by the longer pedicels of the fruits which normally are from one-half to twice longer than the gland, and by the tendency of the filaments to become almost glabrous. Judging by COVILLE's statement with regard to *S. reticulata*, that "in all the other Alaskan willows the filaments are glabrous throughout," I supposed that this fact might furnish a good character to separate specifically the American *S. glauca* from the European-Asiatic species, but a close investigation of all the male specimens at my disposal convinced me that the filaments are always more or less hairy at their base. Specimens like nos. 3369 or 3373 of TRELEASE and SAUNDERS, which apparently have entirely glabrous filaments, do not seem to be pure *S. glauca*, and the American form probably hybridizes with other willows as freely as does the European one.

If we regard the American *S. glauca* as a distinct variety, we have unfortunately to use the varietal name *acutifolia* given by HOOKER to his variety of *S. villosa*, because it antedates ANDERSSON's *S. glauca villosa* by almost 30 years, and apparently represents a rather extreme form with narrowly lanceolate leaves. I regard my determinations as rather provisional, and I am not convinced that my present limitation of the Northeastern American forms of *S. glauca* can be taken as a definite solution of this difficult question.

As previously stated, ANDERSSON also described a *S. glaucops* var. *glabrescens* from specimens collected by BOURGEAU in 1858, probably in Alberta, Rocky Mountains district, near the Bow River Pass. The description runs thus: "*β, glabrescens, amentis crassis vulgo multifloris, foliis rigidioribus supra sparse pilosis demum glabris subtus sat intense glaucis.*" Furthermore he said: "*quam autem glabrescentem appelavi longius distat et S. chlorophyllum (e typo S. phylicifoliae) non parum revocat, foliis glabris supra lucidis et nervosis subtus glaucis reticulatis, amentis multo brevius pedunculatis et capsulis distinctius pedicellatis. Ad S. desertorum manifestissimum praebet transitum.*" There is a specimen of BOURGEAU'S in Herb. G. which, in my opinion, represents a co-type of ANDERSSON'S variety. It bears the label of PALLISER'S Expedition and is named "*S. glauca* L. \times *pallida glabrata* And." ANDERSSON not infrequently changed a name in his publication after having marked the herbarium sheets in a different way. The specimen consists of 2 pieces of well fruiting branchlets. The aments measure up to 5:1.5 cm. and do not differ from typical var. *acutifolia* (syn. var. *villosa*) as collected by BOURGEAU and DRUMMOND in the Rockies. The co-type before me apparently represents a less glabrescent form, and it approaches much the other variety, with which it seems connected by a whole series of intermediate forms. The most glabrous ones I have seen were collected in the vicinity of Dawson, Yukon Territory. I deem it best to give the following characteristics and synonymy of the two varieties:

1. *S. GLAUCA* var. ***acutifolia***, comb. nov.—*S. villosa* Barratt apud HOOKER, Fl. Bor.-Am. 2:144. 1839, p.p.; SEEMANN, Bot. Voy. Herald 39 (Fl. W. Eskimaux Land). 1852.—*S. villosa* var. *acutifolia* Hook., Fl. l.c.—*S. glauca* var. *villosa* And. in Öfv. K. Vet.-Akad. Förh. 15:127. 1858, p.p.—*S. glaucops a villosa* And. in DC. Prodr. 16²:281. 1868, p.p.—*S. glauca* Richardson in FRANKLIN, Narr. Jour. Polar Sea, Bot. App. 753. 1833, non L.; COVILLE in Proc. Wash. Acad. 3:321. pl. 39. 1901.—? *S. glauca subarctica* Kjellman, Fanerog. Vest-Eskim. Land 51. 1883, in Nordenskiöld, Vega Exp. Vet. Takttag. 2:51. 1883, non Ldstr.—*S. Seemannii* Rydbg. in Bull. N.Y. Bot. Gard. 2:164. 1901.—*S. glauca*, var. *Seemannii* Ostenfeld in Vid.-Selsk. Skrift. I. Math.-Nat. Kl. 1909.

no. 8:34 (Vasc. Pl. Arc. N. Am. Gjöa Exp. 1904-6). 1910.—Frutex erectus, 0.5-1.5 m. altus; ramuli novelli dense albo-sericeo-villosi vel villosotomentosi, hornotini vix vel paullo glabrescentes, annotini biennesque pl. m. purpureo-brunnei vel epidermide secedente flavo-cinereo-brunnei, sparse vel partim villosotomentosi vel glabrati, interdum pl. m. nitiduli, circ. 2-3 mm. crassi, vetustiores similes, glabri, saepe castanei; gemmae ut videtur ovatae, ventre pl. m. applanatae, apice saepe rostratae, obtusae, initio dense pilosae, demum fere glabrae, purpureo-brunneae, 4-5 mm. longae. Folia adulta pl. m. chartacea vel papyracea, inferiora minora (vel pedunculorum) elliptica, obovato-oblonga, oblanceolata, vel obovalia, basi obtusa vel vulgo cuneata, apice obtusa ad subacuta vel subrotunda et apiculata, integerrima, minimis margine saepe tenuiter glanduloso-denticulatis exceptis circ. 2:0.8 ad 3.5-4:1.5 cm. magna, superiora majora late lanceolata vel oblanceolata, elliptico- vel obovato-oblonga, ovato- vel obovato-elliptica, apice obtusa vel acuta vel fere breviter subacuminata, basi obtusa vel vulgo subito vel sensim cuneata, 5:1.5 vel 4.5:2 ad 7:2.3 cm. magna, surculorum saepe late ovato- vel obovato-oblonga vel late elliptica, 7:3 ad 12:6.5 cm. magna, maxima interdum margine distincte breviter denticulata, superne novella adpresse sericeo-villosa, etiam adulta pl. m. villosula vel vulgo glabrescentia, ad costam marginemque tantum distinctius villosula, estomatifera, costa nervisque lateralibus planis vel subimpressis, nervillis satis indistinctis, subtus novella densius quam superne sericeo-villosa, etiam adulta pl. m. adpresse sericea vel villosula, valde discoloria, albescentia vel glaucescentia, costa flavescens nervisque lateralibus utrinque circ. 6-10 pl. m. elevatis, nervillis saltem in foliis adultis tenuiter prominulis. Petioli 3-12 mm., in surculis ad 2 cm., longi, superne sulcati, ut ramuli pilosi, vel dein glabrati, flavescens. Stipulae ut videtur semper evolutae, in ramulis vegetis maximae, pl. m. lineari- ad semi-cordato-lanceolatae, rarius semiovato-rotundae, satis distincte glanduloso-denticulatae, ut folia pilosa, petiolo duplo breviores ad $\frac{1}{3}$ vel fere duplo longiores, maximae surculorum ad 3:1 cm. magnae. Amenta coetanea vel subserotina, pedunculos ut rami pilosos foliatis terminatia, satis longe cylindrica, sub anthesi vulgo densiflora, rhachide villosa;

mascula pedunculis 0.5 ad 1.5 cm. longis exceptis (2-)2.5-4 cm. longa et 0.8-1 cm. crassa; bracteae oblongae vel obovato-oblongae, apice obtusae vel rotundae, rarius acutiusculae, concolores et stramineae vel ut videtur saepius pl. m. bicolores, apice purpurascens vel fuscescentes, utrinque villosae et apice pl. m. sericeo-villosae; stamina 2, filamenta libera (rariter ad basim paullo connata), basi vel fere ad medium pl. m. pilosa (an interdum glabra?), adulta bracteis duplo ad 2.5plo longiora; antherae ut videtur ellipsoideae, flavae vel initio roseae; glandulae vulgo 2, interdum dorsalis non visa; ventralis late ovato-rectangularis vel oblongo-conica, apice truncata vel apice incisa vel bi(-3)fida, quam bractea 2-2.5plo brevior; dorsalis vulgo distincte minor et angustior, integra; feminea sub anthesi vulgo 2-4:0.8-1 cm. magna, fructifera laxiora satis elongata 3.5 ad 7 cm. longa et circ. 1.5 cm. crassa, pedunculis 1-3 cm. longis exclusis; bracteae oblongae, obtusae, iis florum mascul. similes; ovaria sub anthesi ovoideo-oblonga, subsessilia vel pedicello glandula brevior suffulta, dense albo- vel griseo-villoso-tomentosa; styli distincti, subcrassi, integri vel apice bifidi vel fere bipartiti brachiis saepe divaricatis quam stigmata bifida oblonga vix vel circ. $\frac{1}{2}$ plo longiores; glandula 1, ventralis, pl. m. late ovato-rectangularis et integra vel bifida ad bipartita, bractea circ. duplo brevior; fructus maturi ellipsoideo-conici, ut ovaria vel laxius villosi, pedicello vulgo distincto glandulam interdum $\frac{1}{2}$ (rarius 2plo) superante excluso (6-)7-8(-9) mm. longi, valvis apertis paullo recurvatis.

This variety seems closely connected with the following one by intermediate forms, although the extremes look rather different.

S. GLAUCA var. **glabrescens**, nov. comb.—*S. glaucops*, var. *glabrescens* And. in DC. Prodr. 16²:281. 1868.—*S. Austinae* Rydbg., Fl. Rocky Mts. 198. 1917, non Bebb, pro parte.—Frutex ut in var. *acutifolia* descriptus, ab ea signis sequentibus praecipue differt: ramuli novelli vulgo minus dense villosi, hornotini pl. m. glabrescentes, rarius ab initio fere glabri vel citissime glabri, annotini biennesque glabri vel sparse (saltem partim) pilosi, olivaceo-purpurascens, pl. m. nitiduli; folia apice saepe magis acuta, margine (saltem inferiora) saepius sed satis obsolete denticulata, majora

obovato-elliptico-oblonga vel late elliptico-lanceolata ad 6-7:2-2.5 cm. magna, superne saepe ab initio glabra, vividius colorata, subtus novella tantum pl. m. dense villosa, citius quam in *acutifolia* glabrescentia, adulta fere glabra vel parce pilosa, albescentia; filamenta basi sparsius pilosa, bracteae florum satis glabrescentes; amenta fructifera in co-typo ad 5 cm. longa et 1.5 cm. crassa, basi vix laxiflora, sed vulgo satis variabilia et basi pl. m. laxiflora; fructus pl. m. glabriores vel basi glabri.

So far as I can see, the range of var. *glabrescens* extends through the Rockies of Alberta and British Columbia to the northwest corner of this state and adjacent Alaska northward into the Yukon Territory, in the vicinity of Dawson. It probably occurs also in Alaska and the eastern Northwest Territories together with var. *acutifolia*.

As mentioned in the synonymy, RYDBERG has used the name *S. Austinae* Bebb as the specific designation for *S. glaucops glabrescens* And., but he also determined forms of a different origin as *S. Austinae*. This species had been proposed by BEBB in Watson, Bot. Calif. 2:88. 1879, but BEBB himself stated (in BOT. GAZ. 16:106. 1891) that it forms a mixture of 3 species, including *S. Lemmonii* Bebb and *S. lasiolepis* Bth. The female piece only represented an apparently new willow, and it is described as having "sessile aments appearing before the leaves, with small early deciduous bracts, dark scales, clothed with silky hairs." I fail to see how the name given to such a different form can be applied to *S. glauca glabrescens* even if we raise this variety to a specific rank.

Before it is possible to define correctly a variety like *glabrescens* we have to become much better acquainted with *S. pseudolapponum*, the so-called *S. glaucops* of the Rocky Mountain floras.

A few words must be said about the "*glauca*" of northeastern arctic America and of Greenland. I have to take into consideration the willows of Greenland because the flora of (at least western) Greenland is essentially American, and the forms of Labrador and northeastern arctic Canada cannot be properly understood without elucidating those of Greenland. The best enumeration of Greenland's *Salix* has hitherto been given by LANGE in his Conspectus Fl. Green. pt. 1. 1880 and pt. 2. 1887. In 1880 he cites not less than 5 varieties under *S. glauca*, which I cannot interpret correctly without comparing the specimens LANGE had before him, which are preserved in the herbarium at Copenhagen. So far as I can judge by the figures and quotations cited by LANGE, none of those varieties

seems to be identical with the typical *S. glauca* or any of the forms of Northeastern Canada. The specimens from Labrador and Greenland referred to *S. glauca* by RYDBERG do not belong to it or are at least very uncertain in their relationship. There is only one form before me which seems to be closely connected with the true *S. glauca*, and of this I shall say something under *S. anamesa*, after having discussed the types and relatives of *S. desertorum*, *S. pseudolapponum*, and *S. cordifolia*.

2. *S. DESERTORUM* Richardson, Bot. App. in Franklin, Narr. Jour. Polar Sea 753 (reprint p. 25). 1833; ed. 2. 765 (reprint p. 37). 1833; HOOKER, Fl. Bor.-Am. 2:151. 1839, pro parte; ANDERSSON in DC. Prodr. 16²:281. 1868, excl. var.; RYDBERG in Bull. N.Y. Bot. Gard. 1:272. 1899; excl. specim. Drummond.; BALL in Trans. St. Louis Acad. Sci. 9:85. 1899, pro parte.—*S. glauca* **S. desertorum* And. in Öfv. K. Vet.-Akad. Förh. 127. 1858.—This is one of the most misunderstood willows, and I am sorry to say that I have not yet been able to explain it sufficiently. The type was collected by RICHARDSON at old Fort Franklin on the Mackenzie River. I have before me a photograph and fragments of the type material preserved in the Hookerian Herbarium at Kew, which show that the specimens distributed by BARRATT under no. 70 are identical with it. Unfortunately all the specimens have only young flowers and leaves except a few fragments of a fruiting catkin of the previous year in the Kew specimen. HOOKER (1839) referred to *S. desertorum* also specimens collected by DRUMMOND, and BEBB (apud ROTHROCK in Wheeler, Rep. U.S. Geol. Surv. West of 100th merid. 6:Bot. 241. 1878) apparently took DRUMMOND'S no. 657 for the typical *S. desertorum*, as did BALL (1899) on BEBB'S authority. RYDBERG (1899) said: "It is evident that Mr. BEBB did not exactly know the true *S. desertorum*," and he stated that it is DRUMMOND'S no. 658 that "matches RICHARDSON'S specimens exactly." Both of DRUMMOND'S specimens are before me. There is no doubt that no. 657 belongs to *S. brachycarpa* Nutt. (*S. stricta* Rydbg.), but I am likewise convinced that no. 658 is not identical with RICHARDSON'S type. This number consists of two young male and female branchlets, and it differs chiefly by the pubescence of the young parts (the lower surface of the leaves, etc.) which is

mixed with minute fulvous hairs, by the rather long pedicel of the young ovaries which is about twice as long as the gland, and by the absence of a dorsal gland in the male flowers. At present I am unable to determine this plant correctly, as we do not know much of the *Salix* of the regions where DRUMMOND⁴ collected.

ANDERSSON first mentioned *S. desertorum* quasi as a subspecies of *S. glauca*, and he said: "Insignis sane est forma, in orbe vetere quantum scio, non crescens. . . . Transitus vero ad normalem *S. glaucam* non nunquam reperti; videtur itaque hujus modificatio frigida." In 1868 he kept *S. desertorum* as a species, and added the following varieties: α , *elata*, β , *stricta*, and γ , *fruticulosa*. The last two are, in my opinion, nothing but *S. brachycarpa* Nutt. The first is based on specimens collected by DRUMMOND in the Rockies, but no number is given. It is described as "frutex 4-5-pedalis, ramis subsimplicibus crassis rufescentibus, foliis basi subangustatis supra glabris venis modice impressis subtus demum glabrescentibus amentis semipollicem longis." This description rather fits the male pieces of DRUMMOND'S no. 660 in herb. G., while the female piece of this number can hardly be distinguished from *S. brachycarpa*. This male no. 660 is the only one of DRUMMOND'S specimens I have seen that may belong to the true *desertorum*. This seems to be a species confined to the northern parts of Alberta and the Northwest Territories, but the young types are not sufficient to give a correct idea of the species. There is another specimen, however, preserved in the Torrey herbarium at New York and labeled "*Salix desertorum* Fl. Bor. Am." It consists of 4 pieces; a fruiting branchlet in the upper left corner of the sheet, a female one underneath it, and 2 male pieces at the right hand. The fruiting branchlet is undoubtedly *S. brachycarpa*, while the male and female material may be identical with the true *S. desertorum*. The male branchlet seems to represent a late flowering stage, and it bears

⁴ According to J. MACOUN (Cat. Can. Pl. I. preface p. viii. 1883), DRUMMOND "explored the whole country from the Red and Assiniboine Rivers by the North Saskatchewan and Athabasca to the Rocky Mountains." He also "collected in the main range of the Rocky Mountains, between lat. 52-56°, and particularly in the part about the head of the Smoky River, a tributary of the Peace." Dr. J. M. MACOUN is spending the summer of this year in these regions and will probably bring back many of the forms collected by DRUMMOND from their original localities.

rather far advanced leaves, the largest of which measure up to 4 cm. in length and 12 mm. in width. They are narrowly elliptical, acute at both ends, finely puberulous on the midrib and on some of the veins above, and glaucescent and almost wholly glabrous beneath, with an entire, ciliated margin. To the true *S. desertorum* may also belong (at least partly) the following 2 specimens collected by J. W. TYRULL: Hudson Bay, west of Chesterfield Inlet, September 2, 1893 (no. 1711 O., f., fr.), and between Lake Athabaska and Chesterfield Inlet, July-August 1893 (no. 1712 O., m., f.). Both numbers consist of several small pieces apparently taken from different plants, and it is impossible to judge them properly.

I think it best to give the following description of the type material, because I shall not be able to insert *S. desertorum* into the key. Frutex erectus sesquipedalis (fide RICHARDSON), habitu ut videtur *S. pseudolapponum* non absimilis; ramuli novelli satis dense, rarius laxius albo-sericeo-villosi, hornotini paullo glabrescentes, annotini subglabriores vel tantum partim pilosi, brunnescentes vel interdum ut vetustiores vulgo nondum perfecte glabri purpurascences et nitiduli, adulti flavo-brunnei, epidermide griseo secedente obtecti; rami cinereo-badii vel nigrescentes; folia speciminum typicorum valde juvenilia vel vix semi-evoluta membranacea, elliptico-lanceolata vel obovato-lanceolata (ex auctore "exacte elliptica"), apice obtusa vel vulgo pl. m. acuta, basi subito vel sensim in petiolum angustata, superiora integerrima vel tantum versus basim parce et obsolete denticulata, infima fere circumcirca tenuiter glanduloso-subdenticulata, maxime evoluta ad 3:0.9 cm. magna; superne ab initio glabra vel sparse (ad costam densius) villosula, in sicco subnigrescentia, valde indistincte subinciso-nervata et reticulata, stomatibus (an semper?) instructa, subtus pl. m. discoloria, glaucescentia, pruinosa, magis (saltem inferiora) sericeo-villosa sed cito satis glabrescentia pilis adpressis difficile recognoscentibus (tardius evoluta ut videtur distinctius pilosa); petioli nondum satis evoluti, vix ad 5 mm. longi, laxe sericei; stipulae nullae vel vulgo pl. m. evolutae, minimae vel parvae, maximae lanceolatae, glanduloso-denticulatae, parce pilosae, petiolis circ. $\frac{1}{3}$ — $\frac{1}{2}$ breviores; amenta coetanea vel subserotina, cylindrica, ramulos breves foliatos sub anthesi vix ad 1 cm. longos terminantia, rhachide villosa;

mascula 2-3.5 cm. longa et circ. 8 mm. crassa, densiflora; bracteae oblongae ad obovatae, apice obtusae rotundatae, stramineae vel flavo-brunneae (vix fuscae), pl.m. laxae praesertim ad apicem sericeo-villosae vel distinctius sericeae, extus saepe glabrescentes; stamina 2 filamentis liberis basi pl.m. pilosis dein bracteis duplo superantibus; antherae flavae(?), ellipsoideae, satis parvae; glandulae 2, ventralis ovato-conica, apice truncata, interdum pl.m. bifida, bractea 2.5-3plo brevior, dorsalis minor, angustior, vulgo integra; feminea sub anthesi 1.5-3:0.7 cm. magna; bracteae ut in masculis, sed brevius villosae, vix sericeae; ovaria oblongo-ellipsoidea, albo-villoso-tomentosa, sessilia vel subsessilia, styli sub anthesi breves, stigmatibus brevibus oblongis bifidis vix longiores, integri vel apice breviter bifidi; glandula 1, elongato-conica, apice truncata vel subretusa, interdum leviter incrassata, bractea duplo brevior; fructus tantum pauci anni praeteriti ex herbario Kewensi visi ellipsoideo-conici, subrostrati, circ. 6.5 mm. longi, satis glabrescentes vel tantum basi pedicelloque quam glandula subduplo brevior pilosi.

3. *S. PSEUDOLAPPONUM* v. Seemen in Bot. Jahrb. 29. Beibl. 65: 28. 1900; RYDBERG, Fl. Rocky Mts. 197. 1917.—*S. glauca villosa* Andersson in Öfv. K. Vet.-Akad. Förh. 15:127. 1858, pro parte; BEBB in Coult., Man. Bot. Rocky Mts. 338. 1885, pro parte max.—*S. glaucops* Rydberg in Bull. N.Y. Bot. Gard. 1:270. 1899, p.p.m.; BALL in Coult. and Nels., New Man. Rocky Mts. Bot. 135. 1909, p.p.m.—*S. desertorum* Ball in Trans. St. Louis Acad. Sci. 9:85. 1899, pro parte.—*S. glauca* var. ? Ball, l.c. 88, p.p.—*S. Wolfii* var. *pseudolapponum* Jones, Willow Fam. 17. 1908, prob. tantum ex parte.—To understand this species it is necessary to compare the explanations given under *S. brachycarpa* and *S. desertorum*. As I have already explained under *S. glauca*, the names *S. glaucops* and *S. glauca villosa* And. cannot be used for those forms which are named *S. glaucops* by BALL and also by RYDBERG, who keeps *S. pseudolapponum* as a different species. In his *Flora Colorado* 93. 1906, he distinguished them in the key by the following characters: "Leaf-blades oblong or linear-oblong; bracts obovate; shrub depressed," *S. pseudolapponum*, and "leaf-blades oblanceolate or obovate-lanceolate; bracts oblong; shrub not depressed,"

S. glaucops. In his *Fl. Rocky Mts.* 190. 1917, he says the same and adds that the leaves are 2-3 cm. long in the first, while they measure 3-6 cm. in length in the second species. The largest leaves of *S. pseudolapponum* I have seen measured up to 5.5:1.8 cm., but usually they are not longer than 4-4.5 cm., and from about 1.5 to 2.2 cm. wide. RYDBERG apparently refers to his *glaucops* some forms which I do not regard as belonging to it, giving as the range "Alta.—N.M.—Utah—Calif.—Yukon," while he restricts *S. pseudolapponum* to Colorado. The type of this species (*Baker, Earle, and Tracy*, no. 300 $\frac{1}{2}$, male) came from Mount Hesperus in the La Plata Mountains in southwestern Colorado, and represents a young flowering stage which naturally looks rather different from a fully developed specimen with old fruits. After having compared an extensive series of well collected specimens, I fail to see how it is possible to separate specifically this southern Colorado plant from the other forms in Colorado, where the species seems to have its headquarters, but the typical *S. pseudolapponum* may represent a dwarfed more alpine form of the so-called *S. glaucops*, which, therefore, should be distinguished as a new variety of *S. pseudolapponum*. There are several forms which otherwise seem to be identical but do not have stomata in the upper leaf epidermis, with which the typical *S. pseudolapponum* is always provided, differing in this respect from *S. brachycarpa* (see later). So far as I can judge by the copious material before me, these two species seem to hybridize rather freely, and I cannot explain certain forms in any other way. We need, however, a much more careful study of these forms in the field to decide the question whether these hybrids are common. From New Mexico I know *S. pseudolapponum* only in a somewhat uncertain sterile form from Taos County, Costilla Valley (leg. *E. O. Wooton*, September 4, 1914), and from Wyoming I saw no specimen but *Nelson's* no. 7831 from the Medicine Bow Mountains in Albany County. From farther northward I saw specimens from Teton County, Montana (leg. *C. S. Sargent* in 1883), and from Alberta, Sulphur Mountain, near Banff (leg. *A. Rehder*, August 8, 1904). Specimens from Lake County, Utah, need further observation, and I have seen nothing from Nevada, California, Oregon, or Washington which I can refer

to this species. A more intimate acquaintance with the *Salix* flora of these regions may lead me to a different opinion, but I hesitate to refer any doubtful forms to a certain species as long as I do not yet know all the other willows that may occur in the locality. Different species may sometimes look very similar at a certain stage of their development, and it needs a long time and the most scrupulous observation to become familiar with the variation of such polymorphic plants as the willows usually are.

4. *S. BRACHYCARPA* Nutt., North Am. Sylva 1:69. 1843; RYDBERG, Fl. Colorado, 95. 1906; Fl. Rocky Mts. 197. 1917; BALL in Coult. and Nelson, New Man. R. Mt. Bot. 135. 1909.—*S. desertorum* Andersson in DC. Prodr. 16²:281. 1868, saltem var. β et γ , non Richardson; BEBB apud ROTHROCK in Wheeler, Rep. U.S. Geog. Surv. west 100th Merid. 6: Bot. 241. 1878; in Coulter, Man. Bot. R. Mts. 338. 1885, excl. var.; BALL in Trans. Acad. Sci. St. Louis 9:85. 1899, pro parte.—*S. stricta* Rydbg. in Bull. N.Y. Bot. Gard. 1:273. 1899; in Mem. N.Y. Bot. Gard. 1:114 (Cat. Fl. Mont.). 1900.—The type of this graceful and well marked species was collected by NUTTALL in August 1818 “in the Rocky Mountain range, on the borders of the Bear River, a clear rapid brook cutting its way through basaltic dykes to the curious lake of Timpanagos, in New Mexico” (now the Great Salt Lake of Utah). No type specimen seems to be in existence, neither have I seen a plant from the type locality, but NUTTALL’s ample and vivid description leaves no doubt as to the form of which he is speaking. ANDERSSON entirely misunderstood this species when (in 1867 and 1868) he added NUTTALL’s name with ? as a synonym to his *S. longifolia argyrophylla angustissima*. ROWLEE (in Bull. Torr. Bot. Club 27:248. 1900) seems to have been the first who reinstated NUTTALL’s name for *S. stricta* (And.) Rydbg. As already stated, *S. brachycarpa* is apparently connected with *S. pseudolapponum* by intermediate forms, and in 1899, through his investigation of the Rocky Mountain material, BALL was led “to the conclusion that no rigid line can be drawn between the species as they are represented in that region.” The extreme forms, he said, are widely divergent, but the numerous intermediates present an almost perfect gradation between these extremes. After all, this

is true only to a certain degree, and in my opinion the difficulty might be settled by regarding the intermediate forms as hybrids. Compared with each other, *S. brachycarpa* is distinguished by the denser and shorter, almost tomentose pubescence, the absence of stomata in the upper leaf epidermis, the shorter petioles, and the denser and shorter aments, especially the staminate with their minute globose anthers; while *S. pseudolapponum* seems to be well marked by the looser, almost a little silky-villose pubescence, the relatively longer petioles, the presence of more or less numerous stomata in the upper leaf surface, and by the somewhat looser male aments with rather stiff filaments and larger, more ellipsoid anthers. In the female aments the differences are often less obvious, and the differences given by BALL (1909) and by RYDBERG (1917) seem to me not borne out in fact.

I have seen no material of *S. brachycarpa* from Utah where the type had been collected. The species seems to be abundant in central Colorado from the Culebra Range in the south to the Medicine Bow Mountains in the north, and southern Wyoming, where it is frequently met with in the western part of the state and in or near the region of the Yellowstone Park, including northeastern Idaho and southern Montana. There is also a specimen before me from the Wallowa Mountains in southeastern Oregon (*Cusick*, no. 2298). From northern Montana its range extends in the Rockies to about 59° N. lat. and about 122° W. long., while in Alberta it occurs east of the Athabasca River through Saskatchewan to about 59° N. lat. I also have before me specimens from Churchill on the western shore of the Hudson Bay in Manitoba, and from the Gaspé Peninsula, which I am unable to separate even as a variety. At first sight the eastern forms seem to differ by the relatively shorter and broader leaves, the somewhat longer styles, and the longer ventral glands, but the same variations can be observed in western specimens. The form from Churchill (*J. M. Macoun*, no. 79156 O.), however, needs further observation. An uncertain form is represented by no. 74. Hb. H.B. and T. (fr.; N.), named *S. desertorum* var. *acutifolia*. It differs from the type by foliis subacutis ad 32:9 mm. magnis et praecipue amentis fructiferis satis laxifloris ad 3.5:1 cm. magnis.

Professor J. M. MACOUN, to whom I am indebted for much help, has collected in company with M. O. MOLTE a very interesting variety at Jasper Park, Alberta, on the low point running into the Athabasca River on the west side of the discharge of Beauvert Lake, July 30, 1917 (no. 95374, fr.; O.), which has glabrous or almost glabrous ovaries and fruits. It resembles *S. chlorolepis*, but the leaves of this species possess stomata in the upper surface which soon becomes glabrous, while in the western form the leaves are without stomata as in typical *S. brachycarpa* and have the same kind of pubescence. I also received a male specimen collected by J. M. MACOUN at the same place as the female type on July 23, 1918, and I am giving the following description of this variety for which I propose the name:

S. BRACHYCARPA var. **glabelllicarpa**, nov. var.—Frutex ut videtur parvus, dense et breviter ut in var. *typica* ramosus; ramuli novelli vetustioresque ut in illa; folia conferta, anguste lanceolata, oblanceolata vel anguste elliptico-lanceolata, apice acuta vel subito apiculata, basi cuneata ad subrotunda, 7:2 ad 28:8 mm. magna, integerrima, sed infima pl.m. dense tenuiter glanduloso-denticulata, superne infimis exceptis pl.m. laxe villosula, vivide (?) viridia, estomatifera, costa rubescente vel flavescente subimpressa nervis vix visibilibus, subtus discoloria, glaucescentia, densius villosula vel inferiora initio magis sericea demum glabrescentia, costa prominente, nervis lateralibus utrinque ad 8 angulo acuto a costa abeuntibus vix vel paullo prominulis; petioli 1–3 mm. longi gemmis (an satis evolutis?) ad subduplo longiores; amenta pedunculo ad 5 mm. longo normaliter foliato suffulta; mascula circ. 8:5 mm. magna ceterum a typo non diversa; fructifera circ. 1:1 cm. magna, subglobosa; ovaria sessilia vel subsessilia, glabra vel ad apicem parce villosa, stylo integro, stigmatibus siccis parvis bifidis ad 2.5plo longiore coronata; glandula 1, ventralis, anguste ovato-conica, quam bractea obovata flavescentia vel apice straminea utrinque laxe villosa subduplo brevior; fructus ovoideo-conici, 4–5 mm. longi, ut ovaria glabra vel apice sparse pilosa.

5. *S. CHLOROLEPIS* Fernald in *Rhodora* 7:186. 1905, is a species peculiar to the Gaspé Peninsula, where it was detected in 1905 at the headquarters of Ruisseau du Diable on the famous Mount

Albert by *Fernald* and *Collins* (no. 59, m., f.; G., type). As FERNALD has already pointed out, it closely simulates in habit, bark, and foliage *S. brachycarpa*, but differs from it by its glabrous capsules and glabrous green bracts. There are, however, pubescent forms which look rather intermediate between *S. brachycarpa* and *S. chlorolepis*, and which have been taken for hybrids by FERNALD. The main difference between the two species is, in my opinion, found in the glabrousness of the filaments in *chlorolepis*, which are more or less pilose in *brachycarpa*, and in the presence of numerous stomata in the upper leaf epidermis of *S. chlorolepis*, while *S. brachycarpa* is entirely destitute of them. The pubescent form agrees well with typical *S. chlorolepis* in this respect, and cannot therefore be regarded as of hybrid origin; consequently I propose the following variety:

S. CHLOROLEPIS var. **antimima**,⁵ var. nov.—*S. desertorum* Fernald in schedis, non Richardson.—A var. typica nonnisi differt ramulis foliisque novellis bracteis vulgo extus et ovariis omnino vel parte superiore pl.m. breviter cinereo-villosulis, foliis vulgo oblongioribus ad 3:1 cm. magnis etiam adultioribus subtus saepe sparse pilosis.

The following specimens have been examined: Quebec: Gaspé Peninsula, Mt. Albert, on wet serpentine slopes, July 23, 1906, *Fernald* and *Collins* (nos. 512, 512^a, f., 512^c, f., type, 512^b, f., 512^e, fr., 512^f, m.; G.); July 21, 1906, *Fernald* and *Collins* (nos. 518, m. paratype, 519, f.; G.; no. 519 forma intermedia inter var. typicam et var. antimimam videtur et ab cl. FERNALD sub nomine *chlorolepis* × *desertorum* distributa est); ravine of cold brook, local, alt. 900 m., August 12, 1905, *Collins* and *Fernald* (no. 64, m., f.; A., N.; "ascending shrubs 3–6 dm. high"). There are indeed also some forms which have to be regarded as true hybrids between *S. chlorolepis* and *S. brachycarpa*. I shall deal with them on a later occasion.

6. *S. NIPHOCALDA* Rydberg in Bull. N.Y. Bot. Gard. 1:272. 1899; COVILLE in Proc. Wash. Acad. Sc. 3:322. fig. 20. 1901.—This species is still very little known. Its type was collected in 1892 by Miss E. TAYLOR in the Northwest Territories on the "Mackenzie River, at a point 30 miles north of the Arctic Circle." I did not see the type specimen, but the specimens mentioned by COVILLE (*F. Funston*, no. 185 and *E. A.* and *A. E. Prebble* no. 26),

⁵ Derived from ἀντίμιμος, closely resembling.

who identified them with the type. The first came from the mouth of the Porcupine River in eastern Alaska, while the second was found near the mouth of the Seal River, 40 miles northwest of Fort Churchill on the Hudson Bay. Through the kindness of Professor J. M. MACOUN I saw also a small specimen collected by *F. Johansen* at Icy Reef in northeastern Alaska in 1914 (no. 164 or 93794 O.), which agrees well with *Funston* no. 185. *S. niphoclada* is "apparently nearest related to *S. stricta*" (*S. brachycarpa*) as stated by RYDBERG, while COVILLE was of the opinion that "the nearest relative to the species among American willows is *S. glauca*." In some respects *S. niphoclada* seems to approach *S. desertorum*, which, however, is still too insufficiently known. The statement in RYDBERG'S description, "style 5 mm. long," is clearly a misprint for 0.5 mm. Owing to the lack of more copious material I am unable to elucidate the genetic relations between *S. desertorum*, *S. niphoclada*, and *S. brachycarpa*, nor can I properly define the taxonomic characters of the first 2 species. The most significant character of *S. niphoclada* seems to me the dense white silky-villose pubescence of the first season's shoots combined with the very short and densely silky petioles, which apparently do not exceed 2 mm. in length, while they are about twice as long and more obvious in *S. desertorum*. I am not inclined, therefore, to refer *Seton* and *Prebble's* no. 79 (no. 78300 O.) from the Mackenzie district, Artillery Lake, Last woods, to *S. niphoclada*, as it has been determined by BALL, as it seems to me more closely related to *S. desertorum*. We know, however, almost nothing of the *Salix* flora of the woodland region of the Northwest Territories, which must be an Eldorado for willows.

The following species which I propose is likewise characterized by the very short petioles, but it has an entirely different prostrate habit.

7. ***S. fullertonensis***, nov. spec.—Frutex humilis depressus ramis ramulisque vulgo satis elongatis repentibus, floriferis ut videtur tantum adscendentibus. Ramuli novelli pl.m. villosuli vel breviter sericeo-villosuli, hornotini pl.m. glabrescentes, purpureo-brunnescentes, annotini fere glabri vel partim tomentelli, intense brunnescentes vel fere castanei, interdum subnitiduli, vix ultra 2 mm.

crassi, vetustiores epidermide secedente griseo obtecti; rami pl.m. cinereo-brunnei. Gemmae parvae, oblongae, obtusae, ellipsoideae vel fere ovato-globosae, flavescentes vel purpurascens, initio pilosae, ut videtur vix ultra 2.5 mm. longae. Folia satis parva, adulta sub-chartacea, lanceolata, ovato- vel elliptico-oblonga, interdum anguste ovato-elliptica, elliptica, ovalia vel obovato-oblonga, apice vulgo acuta, rarius obtusa, basi pleraque rotundata, interdum late cuneata, margine integerrima vel rarius basim versus dentibus distantibus minimis glanduliferis paucis instructa, 1:0.4 ad 2.5:0.9 cm. magna vel (in no. 79161) ad 3 cm. longa et ad 1.1 cm. lata, superne novella pl.m. villosula vel etiam adulta nondum glabra, rarius fere ab initio glabra, ut videtur intense sed satis obscure viridia, costa paulo impressa nervis lateralibus subplanis, epidermide (an semper?) stomatifera, margine villosulo-ciliata, subtus discoloria, albescentia vel glaucescentia, pruinosa, novella et etiam adulta ut superne sericeo-villosula vel demum fere glabra, costa flavescente elevata nervisque lateralibus utrinque 5-8 prominulis ceterum satis indistincte tenuiter reticulata; petioli brevissimi, gemmis duplo breviores ad aequilongi, superne sulcati, pilosi, basi dilatati, vix ultra 2 mm. longi; stipulae vulgo evolutae, semicordatae vel semiovato-lanceolatae, acutae, pl.m. glanduloso-denticulatae, pilosae, 1-3 mm. longae. Amenta tantum feminea saepius fructifera visa, pedunculis (0.5-)1-2 cm. longis foliatis suffulta, cylindrica, sublaxiflora, sub anthesi circ. 1.2-1.5:0.5 cm., fructifera 2:1 ad 4:1.3 cm. magna; ovaria ovoideo-conica, dense griseo-villoso-tomentosa, sessilia, stylo brevi semipartito vel integro quam stigmata oblonga subbreviore ad sublongiore coronata; bractae anguste oblongae, obtusae (in no. 79161 obovali-oblongae), brunnescentes, villosulae vel sericeo-villosulae, extus ad apicem interdum glabrescentes; glandula 1, ventralis, anguste ovato-conica, apice truncata, integra vel pl.m. bifida bipartitave, quam bractea circ. duplo brevior, in no. 79161 interdum glandula dorsalis parva visa; fructus anguste ovoideo-conici, ut ovaria vel minus dense tomentosi, sessiles vel subsessiles, 4-6 (vel ad 7) mm. longi.

TYPE LOCALITY: Eastern Canada, Hudson Bay, Fullerton, lat. 63°57'.

SPECIMENS EXAMINED: Canada: Hudson Bay, Fullerton, September 4, 1910, *J. M. Macoun* (79164, fr.; type; G., N., O.); July 10, 1904, *E. L. Borden*

(no. 63043, f.; N., O.; a young flowering stage); Ranken Inlet, lat. $62^{\circ}45'$, August 30, 1910, *J. M. Macoun* (nos. 79163, 79165, 79166, fr.; Cor., N., O.; identical with type); Bathurst Inlet, Arctic Sound, lat. 67° to 68° N., long. 109° to 111° W., August 25, 1915, *R. M. Anderson* (no. 467 or 93776 O., fr. im.; amentis satis laxifloris); Cape Eskimo, lat. $61^{\circ}05'$, August 26, 1910, *J. M. Macoun* (no. 79161, fr.; Cor., N., O.; forma foliis fructibusque majoribus, saltem in specim. in O., stomata superne in foliis ut videtur deficientibus); Mansfield Island, September 1884, *R. Bell* (no. 24622, fr.; O.; specimen mancum incertum).

This is an interesting willow, and well marked in its typical form by the very short petioles of the small leaves, which are normally provided with stomata in the upper surface. It seems to be an entirely prostrate shrub with very slender creeping branches. Some of the forms I regard as *S. fullertonensis* or nearly related to it have been referred by RYDBERG to his *S. Macounii*, the type of which represents a very different plant, which I shall discuss under *S. cordifolia*.

The following specimens look to me more or less like forms that might be taken for *S. fullertonensis* \times *S. groenlandica*. They seem to differ from *S. fullertonensis* in the following characters: gemmis majoribus ad 5:3 mm. magnis, foliis latioribus ovato- vel obovato-ellipticis ovalibus vel obovato-oblongis apice saepe plicato, acutis basi rotundis ad late cuneatis adultis margine sparse ciliato excepto glabris superne magis nitidulo-viridibus (stomatiferis) subtus paullo distinctius nervatis reticulatisque maximis ad 2.8:1.5 cm. magnis; petiolis ad 4 mm. longis sed gemmas bene evolutas non superantibus; amentis fructiferis fructibusque vix diversis, bracteis late obovatis pl.m. longius et magis sericeo-pilosis; fructibus sessilibus vel pedicello distincto glandulam interdum superante suffultis, circ. 7 mm. longis.

Hudson Bay: lat. $55-56^{\circ}$, barren shores, August 1886, *J. M. Macoun* (no. 18822, fr.; O.; ovariis sessilibus, bracteis sericeis, foliis distincte petiolatis, stomatiferis); Fullerton, September 4, 1910, *J. M. Macoun* (no. 79148 fr.; O.; 79167, fr.; Cor., G., N., O.; forma foliorum ut in *fullertonensi* sed petioli longiores, stomata desunt, ovaria subsessilia, glandulae saepe 2, bractee sericeae); Ranken Inlet, lat. $62^{\circ}45'$, August 30, 1910; *J. M. Macoun* (no. 79162, fr.; Cor., G., N., O.; *S. groenlandicae* satis similis); Nottingham Island, 1884, *R. Bell* (no. 18820¹ olim, = 54358 O., fr. juv.; satis ad *anglorum* spectans sed sine stomata); Digges Island, 1884, *R. Bell* (no. 18820³ olim, = 54359 O.; fragmentum, ut praecedens); Mansfield Island, 1884, *R. Bell* (no. 18820⁵ olim, = 54360 O.; fr.; probabiliter ut praecedens); James Bay mouth of Albany

River, July 25, 1904, *W. Spreadborough* (no. 62618, fr.; O.; magis ad *groenlandicam* spectat); Bathurst Inlet, Katur Point, lat. 67° to 68° N., long. 109° to 111° W., August 22, 1915, *R. M. Anderson* (no. 456 or 93775 O., f.; specimen mancum).

7. *S. CORDIFOLIA* Pursh, Fl. Am. Sept. 2:611. 1814; TRAUTVETTER in Nouv. Mém. Soc. Imp. Nat. Mosc. 2:298. pl. 9 (De Salic. frig. Kochii). 1832; HOOKER, Fl. Bor.-Am. 2:152. 1839, exclud. specim. Drummond.—*S. callicarpaea* Trautv., l.c. 295, pl. 7; RYDBERG in Bull. N.Y. Bot. Gard. 1:270. 1899, quoad specim. labrad.—*S. planifolia* Hook., l.c. 150, quoad specim. labrad. saltem ex parte, probabiliter non Pursh.—*S. alpestris* c) *americana* Andersson in Öfv. K. Vet.-Akad. Förh. 15:129. 1858.—*S. arctica* β *Brownei* 3° *fumosa* And. in DC. Prodr. 16²:287. 1868, quoad pl. labr.—*S. glauca* Rydbg. in Bull. l.c. 271, quoad pl. labr.—*S. Waghornei* Rydbg., l.c., pro parte; BRITTON and BROWN, Ill. Fl. ed. 2. 1:604. fig. 1486. 1913.—*S. labradorica* Rydbg., l.c. 274, pro parte max.—PURSH's description of this species is very short and runs as follows: "*S. depressa*; foliis ovalibus subacutis basi cordatis integerrimis reticulato-venosis supra glabris, subtus pallidis nervo margineque pilosis, stipulis semicordatis." It was taken from a sterile plant cultivated "in Hort. Andersson." PURSH adds "in general habit it resembles *S. myrsinites*." Unfortunately there is no type left by PURSH, but a specimen from ANDERSSON's garden is preserved at Kew, of which I have not yet seen a photograph, but only a rough outline sketch in herb. G. The plant is next mentioned by FORBES (Salict. Wob. 277. fig. 143. 1829), who only translated PURSH's diagnosis. The leaf represented in fig. 143 clearly shows a finely denticulate margin, and it looks much more like a leaf of *S. calcicola* Fern. I am unable to ascertain its identity. HOOKER said: "The plant named for me by Mr. BORRER, who is probably acquainted with the original plant cultivated by ANDERSSON, little deserves the appellation of *cordifolia*, its leaves being more frequently acute than retuse at the base. Many of the specimens approach very near the following" (*S. arctica* R. Br.). I have not yet seen the Labrador type of HOOKER's *cordifolia* collected by KOHLMEISTER. HOOKER also referred to this species specimens collected in the Rockies by DRUMMOND which represent *S. arctica*

subcordata (And.) Schn. (see my first paper). In the synonymy he mentioned *S. obovata* Pursh with a ?, but this species is described with "amentis subcoetaneis sessilibus" and does not apparently belong to our species. Furthermore, HOOKER's *S. planifolia* is the same as *S. cordifolia* as to Miss BRENTON's specimens from Labrador, of which I have a photograph and fragments before me. The sheet in herb. K. contains 6 specimens with fruits and adult female flowers of which only one (the middle piece at the left hand side) seems to belong to a different form on account of the presence of stomata in the upper leaf surface which are wanting in typical *S. cordifolia*.

Judging by the ample descriptions and the figures, TRAUTVETTER's *S. cordifolia* and *S. callicarpaea* seem to represent nothing but two different stages of one species. His *S. cordifolia* is a poor specimen of a female plant with young flowers, while the figure of his *callicarpaea* shows a fruiting specimen collected by HERZBERG at Okak. Of RYDBERG's *S. callicarpaea* I have only seen BELL's Labrador specimen from "Nachhak" (Nachvak), a rather poor and sterile one (no. 18819, O.) which I cannot distinguish from typical *S. cordifolia*.

The other specimen cited by RYDBERG from Mt. Gaspé (probably meaning Mount Albert, Gaspé Peninsula), collected in 1882 by Macoun (no. 18826 O.), has not been available to me; it may belong to *S. anglorum* var. *kophophylla* Schn.

ANDERSSON (1858) divided *S. cordifolia* Hook. in his *S. subcordata* and *S. alpestris americana*, the latter representing the Labrador plant. In the *Prodromus* (1868) no mention is made of his *alpestris* and its 3 varieties of 1858, but only of the older *S. alpestris* Wulfen, which has nothing to do with it. *S. cordifolia* is cited under *S. arctica* β *Brownei* f. 1. *obovata* in the following sentence: "Huc *S. cordifolia* Pursh fl. 2. p. 611; Hook. fl. boreali-amer. 2. 152; Trautv. l.c. p. 298 t. 9 ex Labrador forsan etiam pertinet"; while on the following page under f. 3. *fumosa* of the same variety he says "Nonne haec potissimum: *S. cordifolia* Pursh fl. Amer. syt. 2. 611. ?, Trautv. l.c. p. 298 (quae tamen stylo longissimo insignis videtur!)", and *S. callicarpaea* Trautv. is mentioned as a quasi-synonym under the last form. Besides this ANDERSSON says under *S. pyrenaica*:

"*S. cordifolia americana*, quam olim *S. Pyrenaicae* forma credidimus, vix a formis foliis tenuioribus nigricantibus *S. villosae* est distinguenda." This is a most curious statement, because he never referred *S. cordifolia* (or part of it) to *S. pyrenaica*, but he did propose (1858) a *S. alpestris a pyrenaica* besides his *alpestris americana*. Furthermore, under *S. glaucops* var. *villosa* ANDERSSON (1868) quotes "*S. cordifolia* Hook. Fl. Boreal.-amer. p. 152 p.p. (non Pursh)." These statements convey the impression that ANDERSSON was unable to interpret properly HOOKER's species.

RYDBERG (1899) proposed the new name *S. Waghornei* for *S. cordifolia* Hook., not Pursh, without explaining why both are not identical, and without mentioning the fact that HOOKER in his *cordifolia* also included specimens of DRUMMOND from the "high parts of the Rocky Mountains." He says "Type in Herb. Torrey ('Fl. Am. Bor.),'", which is a poor and almost valueless fragment consisting of one piece with a few remnants of fruits and another small one with undeveloped rather abnormal male catkins. The leaves of both have stomata in the upper epidermis, and the specimen looks more like a hybrid between *S. cordifolia* and *S. anglorum* than like *S. cordifolia*, which is certainly not identical with this "type." I am inclined therefore to use the name *S. Waghornei* for this supposed hybrid.

RYDBERG (1899) proposed 2 more species: *S. atra* and *S. labradorica*. Judging by the type before me, *S. atra* represents nothing but a form of *S. cordifolia*, of which I shall speak later, while *S. labradorica* is still a rather uncertain form because the female type (*Waghorn's* no. 36, 1892) as well as the male syntype (*Waghorn's* no. 31, 1892) differ from typical *S. cordifolia* by the presence of stomata in the upper leaf epidermis. The plants are too young to afford sufficient characters to recognize their real affinity. According to RYDBERG's key, *S. labradorica* differs from the other species by its broadly ovate leaves "with white, villous almost permanent hairs, spreading in all directions," while in *S. Waghornei* and *S. atra* "the leaves are somewhat hairy when young, but the long white hairs are, as in *S. glauca*, appressed and parallel to the midrib." This kind of silky pubescence may be seen on the lower surface of the first (lowermost) leaves of almost all the forms in question,

while the later (superior) leaves bear more or less villous hairs "spreading in all directions," especially on the upper surface if the latter is not glabrous even when young, as is mostly the case with the young (first) leaves of the flowering branchlets. I have been unable to distinguish different forms by the amount or the character of the pubescence, and it is often difficult to determine properly young flowering specimens in the herbarium.

S. cordifolia is a widely distributed and variable species, its range extending from southern Greenland (about the 67th parallel) and Labrador (from the vicinity of Nachvak southward to the Strait of Belle Isle) westward to the western shores of the Hudson Bay (in var. *atra*) and southward to the Mingan Islands and the western Gaspé Peninsula,⁶ northwestern Newfoundland, and in var. *Macounii* to the Bonne Bay region in western Newfoundland, but it is not yet reported from the Bay of Islands or the Blomidon range there. The forms of Greenland which I take for *S. cordifolia* are discussed under *S. anamesa*.

In Labrador it is often represented by the f. **atra** (Rydbg.), nov. forma, which seems to differ from the type only in its more oblong leaves which are acuter at both ends. The "turning black in drying" of the leaves mentioned by RYDBERG seems to me no character of taxonomic value because it is too often only a result of neglect in the press. I shall give an enumeration of the specimens referable to f. *atra* in my final book. At present I wish to draw the attention of collectors to another form for which I propose the name f. **hypoprionota**⁷ nov. forma, because it chiefly differs from the type by its "foliis ex parte pl.m. serrato-denticulatis"; otherwise it seems to vary in the same manner as the type, being sometimes more or less prostrate, sometimes an erect shrub up to 1 m. in height. I refer to it the following specimens:

LABRADOR: Straits of Belle Isle: Blanc Sablon, limestone and calcareous sandstone terraces, by brook, August 1, 1910, *Fernald* and *Wiegand* (nos.

⁶ There is a specimen from Mt. Albert collected August 27, 1882, by *Macoun* (no. 24509 O., with old male aments and mature leaves) which closely simulates the western *S. glauca* var. *acutifolia* from Alberta, and I cannot distinguish another of MACOUN'S specimens of August 2, 1882, said to be collected in "Gaspé, Que." with ripe fruits from the western *S. glauca*. But this has no number and I do not feel quite sure of the locality.

⁷ Derived from ὑπό, somewhat, and πριονωτός, serrated.

3224, f.; G.; foliis elliptico-oblongis paullo ad *f. atram* spectans; 3226 fr. type; G., "shrub 1 m. high"; foliis obovato-ellipticis ad 5.8:3 cm. magnis superne magis quam subtus laxe adpresse villosis vel inferioribus minoribus margine ciliato excepto glabris); Forteau, springy banks and damp hillsides, July 10, 1910, *Fernald* and *Wiegand* (nos. 3210, 3220, fr.; G.); Fox Harbor, near Battle Harbor, September 15, 1891, *Waghorne* (no. 11^a, fr.; Cor.); Ungava, along a river, July 1896, *Spreadborough* (no. 13687^a O.; Cor.); Quebec: Mingan Islands, Ile St. Génève, July 1, 1915, *H. St. John* (no. 90840 O., m., f.; G.); Island of Anticosti, Baie Sainte Claire, August 17-18, 1917, *M. Victorin* (nos. 4349, st., 4350, st., 4351, fr.; A.).

A distinct variety seems to be represented by the typical *S. Macounii* Rydbg., which came from Ellis Bay on Anticosti Island. RYDBERG referred to this species forms of different origin, but mostly those related to *S. fullertonensis* and *S. groenlandica*. It may be briefly characterized as follows:

7b. *S. CORDIFOLIA* var. **Macounii**, nov. var.—*S. Macounii* Rydbg. in Bull. N.Y. Bot. Gard. 1:269. 1899, quoad specim. typic.—*S. Rydbergi*⁸ Heller, Cat. N. Am. Pl. ed. 2. 4. 1900.—*S. vacciniiformis* Rydbg. in BRITTON, Man. Fl. N. St. Can. 319. 1901.—A typo praecipue differt foliis etiam adultis minoribus vix ultra 3:1.5 cm. magnis vulgo satis exacte ellipticis utrinque pl.m. acutis interdum margine pl.m. denticulatis adultis glaberrimis sed novellis pl.m. (saltem superne!) ut in typo villosis; amentis fructiferis vix ultra 3:1 cm. magnis.

TYPE LOCALITY: Island of Anticosti, Ellis Bay.

RANGE: Anticosti and northwestern Newfoundland, possibly also in Labrador and northern Ungava.

SPECIMENS EXAMINED: Quebec: Anticosti, Ellis Bay, September 7, 1883, *J. Macoun* (no. 18830 O., fr.; type).—Newfoundland: Ingornachoix Bay, damp rocky limestone barrens, near the sea level, August 4, 1910, *Fernald* and *Wiegand* (nos. 3203, f., fr., 3207, fr.; G.); dry rocky limestone barrens, near sea level, August 1, 1910, *Fernald* and *Wiegand* (no. 3218, fr.; G.; prostrate); August 2, 1910, *Fernald* and *Wiegand* (no. 3221, f., fr.; G.); Bonne Bay, barrens at the base of the serpentine table lands, August 27, 1910, *Fernald* and *Wiegand* (no. 3229, f.; G.); serpentine table land, alt. about 380 m., same date and collectors (no. 3230, fr.; G.).

⁸ There is no reason according to the international rules or the Philadelphia code to change the name *Macounii* on account of the previous *S. Richardsonii* var. *Macouniana* Bebb, as HELLER in November 1900 and RYDBERG a few months later did, the latter not knowing of HELLER's name.

This variety needs further observation. It seems to be the prevailing one on Anticosti Island and in northwestern Newfoundland. Some more vigorous forms from Blanc Sablon and Forteau with more distinctly denticulate leaves might also be referable to it. RYDBERG's type is a very glabrous specimen collected in September. Forms from Hopedale in Labrador (*Sornborger*, no. extra 1) and northern Ungava (*A. P. Low*, no. 24769 O.) are rather uncertain. Specimens like no. 3207 have the mature leaves entirely glabrous (except a few hairs on the margin), as in the type, while the young parts show a more copious pubescence similar to that of *S. cordifolia typica*.

There are other specimens which I cannot determine properly and which are worth further observation:

Newfoundland: Ingornachoix Bay, Pointe Riche, limestone barrens near sea level, August 4, 1910, *Fernald* and *Wiegand* (no. 3204, fr.; G.), forma foliis pl.m. orbicularibus vel elliptico-rotundis satis ad var. *Macounii* spectans, fere ut in var. *typica* pilosa, sed floribus femineis glandula satis lata (fere ut in *groenlandica*) instructis et fructibus pedicello quam glandula sublongiore suffultis laxe puberulis, stylis brevibus stigmatibus brevibus bifidis vix longioribus, bracteis obovatis substramineis breviter pilosis.—Quebec: Saguenay County, Archipel Ouapitagone, Ile Matchiatik, sprawling on ledge, July 15, 1915, *H. St. John* (no. 90841 O., f.; G.), praecedente non absimilis.

A very uncertain form has been found by *St. John* on the Mingan Islands, Ile au Marteau (Eskimo Island), top of limestone shingle, July 28, 1915 (no. 90837 O., m., f.; G.): ramulis novellis perspicue dense albo-tomentosis, foliis semi-evolutis obovato-ellipticis ad 5:2.5 cm. magnis costa ex parte petioloque excepto glabris superne in epidermide stomatiferis inferioribus ut in f. *hypoprionota* denticulatis, stipulis semiovatis denticulatis glabris, floribus ut in *S. cordifolia* sed bracteis apice interdum leviter fuscis.

Lastly, there remains to be discussed a willow from western Greenland which seems most closely related to *S. cordifolia*, but which also considerably resembles *S. anglorum*, and has apparently been referred by most of the authors to *S. glauca*. I cannot include it among any of the species previously mentioned, but deem it best to propose a new species.

9. *S. anamesa*,⁹ spec. nova.—Frutex ut videtur habitu variabili ut in *S. cordifolia*; ramuli novelli dense sericeo-villosi, hornotini

⁹ Derived from *ἀνάμεσος*, intermediate.

pl.m. glabrescentes, autumnno ut annotini vulgo partim pilosi, badii vel purpurascens, etiam vetustiores saepe vix omnino glabri, dein nigro-purpurascens vel epidermide secedente pl.m. cinereo flavescens, ad circ. 5 mm. crassi. Gemmae ovato-oblongae, obtusiusculae, initio dense pilosae, dein glabrescentes, purpurascens, petiolis duplo breviores. Folia adulta ut videtur papyracea, elliptica, elliptico-oblonga, ovali-elliptica vel elliptico-obovata, minima interdum anguste elliptico-lanceolata vel oblanceolata, margine integerrima vel rarius parva dentibus minimis sparsis glandulosis sub pilis occultis instructa (in no. 156 etiam majora distinctius sparse denticulata), maxima nondum perfecte evoluta ramulorum typi ad 2.5:1 cm. magna, in speciminibus a cl. Hartz in Augusto lectis ad 3.5:1.5 cm. magna et in ramulo vegeto (in no. 156) ad 4.8:2.3 cm. vel in forma satis incerta a Disco Island ad 5:2 cm. magna, superne ut videtur obscure viridia, in sicco vulgo pl.m. nigricantia, novella inferiora adpresse sericea, superiora pl.m. (praesertim versus marginem) villosula, adulta satis glabrescentia sed in costa pl.m. pilosula et margine ciliato-villosa, in epidermide pl.m. (saltem secundum nervos) stomatifera, subtus valde discoloria, glaucescentia, inferiora et novella dense sericea vel sericeo-villosa (pilis adpressis albis vel paullo flavescens), demum glabriora et adulta interdum tantum sparse pilosa, costa nervisque lateralibus 6-10 prominulis flavescens et laxe tenuiter reticulata. Petioli initio dense, dein sparse sericeo-villosi, superne sulcati, 2-5(-6) mm. longi. Stipulae breviter ovatae vel ovato-lanceolatae, acutae, denticulatae, ut folia colorata et pilosa, 1-3 mm. longa vel nulla (punctiformia). Amenta coetanea, ramulos breves dense sericeo-villosos foliatis sub anthesi vix ultra 12 mm. longos terminantia, cylindrica, rhachide sericeo-villosa; mascula 1.2-3:1 cm. magna, basi saepe sublaxiflora; bractae oblongae, obtusae vel subobtusae, stramineae vel apice paullo fuscescentes, omnino sericeo-villosae et apice magis sericeae; stamina 2, filamenta libera, circ. $\frac{1}{3}$ pilosa, bracteis dein duplo longiora; antherae ellipsoideae, mediocres, violaceae (tantum juvenilia?), glandulae 2, ventralis anguste conica, apice truncata, integra vel pl.m. bipartita, dorsalis minor, angustior; feminea 1-2:0.8-0.9 cm., fructifera ut videtur ad 4:1.5 cm. (Hartz, Holstenborg) magna, basi vix distincte laxiflora; bractae ut in masculis, saepe brevius pilosae, omnino stramineae;

ovaria ovoideo-oblonga, dense albo-villoso-tomentosa, subsessilia; styli distincti, bifidi vel bipartiti (brachiis saepe divaricatis) stigmatibus brevibus oblongis bifidis haud vel ad duplo breviores; glandula 1, ventralis, ut in masculis, bractea circ. duplo brevior. Fructus ovoideo-conici, ut videtur ad 8-9 mm. longi, minus dense quam ovaria villosi, subsessiles.

TYPE LOCALITY: South Greenland, Ilua, lat. bor. $59^{\circ}55'$.

RANGE: Southern and western Greenland.

SPECIMENS EXAMINED: Greenland: Ilua, lat. bor. $59^{\circ}55'$, May 15-31, 1889, *E. L. Lundholm* (m., f., type; M.); Sermiliarsuk, circ. $61^{\circ}30'$, August 3, 1889, *N. Hartz* (fr.; N.); Kingua Kuanersok, circ. 62° , July 12, 1889, *N. Hartz* (m.; N.); Kvanefjord S. f. Frederickshaab, 1886, *L. K. Rosenvinge* (no. 18873 O., fr.; needs further observation); Godthaabs district, Kobbefjord, June 28, 1884, *Warming* and *Holm* (m., f.; G.); Holstenborg, June 14, 1889, *N. Hartz* (f., fr. adult.; N.); Disco Island, Godthaab (probably mistake for Godthavn!), July 14, 1892, *W. E. Meehan* (no. 62 or 24768 O., m.; ramulis magis glabrescentibus annotinis fere glabris lucido-purpureis, forma porro observanda); Godthavn, August 2, 1896, *Cornell Party* (m., f.; Cor.; forma ut videtur prostrata aspectu *S. anglorum* non absimilis sed characteribus florum ab *S. anamesa typica* non diversa); Nugsuak Peninsula, Camp 2, August 10, 1896, *Cornell Party* (fr.; Cor.; forma porro observanda, bracteis magis obovatis, fructibus breviter pedicellatis, foliis apice saepe subito breviter plicato-acuminatis); Wilcox Head, August 15, 1896, *Cornell Party* (f., fr.; Cor.; forma porro observanda, amentis fructiferis ad 4.5:1.4 cm. magnis, fructibus pedicello quam glandula vix breviora suffultis, foliis ad 4:2 cm. magnis pl. m. obovato-ellipticis); Camp 3, August 20, 1896, *Cornell Party* (f.; Cor.; forma foliis satis breviter petiolatis ceterum paullo ad *S. anglorum* accedens); Upernivik, $72^{\circ}47'$, July 18, 1886, *L. K. Rosenvinge* (no. 24514 O., f.; looks very much like *S. cordifolia* but the pubescence reminds more of *S. anglorum*; on July 24 the same collector found a specimen at Pröven which I cannot distinguish from *S. anglorum*); Cape York, July 23, 1894, *E. H. Wetherill* (no. 214; G.; specimen mancum dubium tantum amentis fructiferis adultis praeditum habitu valde ad *S. anglorum* spectans sed bracteis breviter villosis oblongis); Omenak (Umanak) Fjord, Omenak Island, August 9, 1897, *D. White* and *Ch. Schuchert* (no. 156, fr.; N.; forma porro observanda, foliis ad 4.5:2 magnis, amentis fructiferis ad 3.5 cm. longis et 1.6 cm. crassis).

As already said, this species is certainly most closely related to *S. cordifolia*, from which it chiefly differs by the presence of stomata in the upper leaf surface. I should have treated it as a variety of this species were it not for the fact that there are a number of quasi intermediate forms between it and *S. anglorum*. On the other

hand, *S. anamesa* is not identical with *S. Waghornei*, which I take for a hybrid between *S. anglorum* and *S. cordifolia*. I have not yet seen any *S. anglorum* south of Disco Island in Greenland, and the Greenland material which I am inclined to refer to *S. cordifolia* is very scanty and needs further observation. From *S. anglorum* the new species may at once be distinguished by its hairy filaments and its narrowly oblong, light brown bracts, which have the rather short and villous pubescence of the *cordifolia* type. It seems to me that *S. anamesa* represents the plant commonly called *S. glauca* by LANGE, HARTZ, and other authors, but I am not sufficiently acquainted with the *Salix* of Greenland, owing to the scarcity of material from there in American herbaria, to give a more proper definition of the so-called *S. glauca* and the numerous varieties of it described by ANDERSSON, LANGE, and others. I do not find in the existing literature a name I could apply to *S. anamesa*. The *Salix* of Greenland seem always to have been compared only with those of Europe, while in fact the material before me indicates a much closer relationship with the species from Northeastern America. If we glance at the varieties of *S. glauca* mentioned from Greenland, we find the following in LANGE's Consp. Fl. Groenland. 1:110. 1880, and 2:279. 1887:

S. glauca var. *sericea* And., the type of which is *S. sericea* Vill., Hist. Pl. Dauph. 1:382. 1786, nom. nud.; 3:782. pl. 51. fig. 27. 1789, and which ANDERSSON refers to his f. 3. *lanceolata*. According to LANGE (1880) this var. *sericea* and also var. *appendiculata* (Vahl) Wahlb. are "tolerably common on some moist places." The latter variety is well figured by VAHL, Fl. Dan. 6. fasc. 18:6. pl. 1056. 1792. Neither of these varieties seems to me identical with the forms I refer to *S. anamesa*. LANGE's third variety, var. *ovalifolia* Lge., Fl. Dan. 17, fasc. 50:11. pl. 2981. 1880 (*S. glauca* a *sericea* 2 *ovalifolia* And.; ?*S. glauca* var. Brown in Trans. Bot. Soc. Edinbgh. 9:450. 1868) pro parte, may be represented by the following 2 specimens before me: Disco Island, September 1854, Lyall (fr.; N., ex Herb. Hook.), and "Gebiet des Umanakfjordes (70-71° N.Br.)," August 18, 1892, E. Vanhöffen (no. 89[220], fr.; N.). The broad-elliptic or oval leaves which measure up to 3.5:2.3 or 5:2.2 cm., and are more or less villous, especially on the rib of the

upper surface and on the margin, do not have stomata in the upper epidermis, and their villous petioles are hardly 5 mm. long. Some of the leaves, especially in no. 89, show a few fine distant teeth toward the base. The branchlets of the season are covered with rather long villous hairs, while the older ones become glabrous and of a shining dark purplish color. The fruiting aments measure up to 4.5 by 1.5 cm., and the capsules are about 10 mm. long, including the very short pedicels. The habit of the plant cannot clearly be recognized, but there is another very similar fruiting specimen collected by *H. E. Wetherill*, at Netiulene, Whale Sound, North Greenland, August 13, 1894 (no. 226; G.), which certainly is taken from a prostrate plant. This number is enumerated by RYDBERG (1899) under *S. anglorum*, but it lacks the stomata in the upper epidermis, and seems more closely connected with the var. *ovalifolia*, being however a little more glabrescent than the other 2 specimens mentioned. The sessile capsules are about 8 mm. long, and the bracts somewhat darker.

The var. *angustifolia* Lange, Fl. Dan. 17. fasc. 50:11. pl. 2982. 1880, is a very striking narrow-leaved form, the type of which came from Iceland ("prope Myvatu Islandiae legit cl. Lundgren"). I much doubt if it is the same as *S. glauca* α *sericea* γ *angustifolia* And. (1868). LANGE (Consp. Fl. Gr. 1:110) refers to it specimens from western and eastern Greenland which I have had no opportunity to compare. The only specimen I saw which somewhat resembles LANGE's plate is *Wetherill's* no. 225 from the north side of the Jones Sound, August 1894 (f.; G.), but here the leaves have stomata in the upper epidermis and the rather silky pubescence of the dark bracts points more to *S. anglorum*, of which it may be a narrow-leaved form. I have seen rather similar specimens of *S. anglorum* from southwestern Victoria Land (*R. M. Anderson*) and north-eastern Greenland (*A. Lundager*).

LANGE's last var. *alpina* (not *S. glauca* δ *alpina* And., which is the same as *S. glauca* β *macrocarpa* Ledeb.) is described as a "fruticulus humilis, repens vel prostratus, ramis adscendentibus, foliis minutis, raro ultra $\frac{1}{2}$ poll. longis," and as the type there has to be taken a specimen collected by *R. Brown* (of Campster) in 1867 at Jakobshavn in western Greenland (*S. glauca* Brown in Trans. Bot.

Soc. Edinbgh 9:430. 1868, pro parte). I have seen nothing identical with this variety; there is only one specimen before me from the "Kvanefjord S. f. Frederickshaab," collected in 1886 by *L. K. Rosenvinge* (no. 18873 O., fr.) which I should take for a small-leaved form of *S. anamesa*, the narrowly elliptical leaves measuring up to 21:9 mm.

I can only repeat that we have to make a much closer investigation of the so-called *S. glauca* of Greenland in order to decide which of the forms can really be referred to the European species. They are certainly not identical with the var. *acutifolia* and var. *glabrescens* previously mentioned. I strongly believe that the true *S. glauca* is entirely absent from Eastern North America, and here represented by *S. cordifolia* and its varieties. It is the main purpose of these explanations to call attention to what is still unknown of the difficult forms of this group of willows, of which the following remains to be discussed.

10. *S. LINGULATA* Andersson in DC. Prodr. 16²:281. 1868; Herder in Act. Hort. Bot. Petrop. 11:437. 1891.—This is a very poorly known Alaskan species not mentioned by COVILLE. ANDERSSON described it from specimens collected by *Kostalsky* "ad Alaxa" as a low shrub resembling in habit a small *S. arbuscula*. There are a few fragments in herb. N. ex Herb. Fischer which agree well with ANDERSSON'S description (except that the leaves are not quite glabrous above), but are much too scanty to give a distinct impression of this species. The flowers, etc., suggest those of *S. desertorum*, and *S. lingulata* is certainly closely connected with the species of the GLAUCAE with pilose filaments, but has nothing in common with *S. reticulata*, to which it is said by ANDERSSON "capsulis globoso-ovalibus . . . sat evidenter referrens."

ARNOLD ARBORETUM
JAMAICA PLAIN, MASS.